ear mold. Sound quality is exceptionally good. This device appears to be an ideal solution for patients with bilateral canal atresia and inoperable conductive hearing loss.

In the other type, which is still in the experimental stage, a small magnet is placed in the middle ear on the stapes at the time of the middle ear operation. The vibrating element may be contained in a middle ear prosthesis and is externally energized using electromagnetic induction through an external hearing aid with coil. In this version the ossicles are directly vibrated rather than the mastoid bone, a much more efficient system. If the operation fails to totally correct the hearing loss, the implant component can be used to produce amplification. Again, the ear canal is open, minimizing the problems of a tight ear mold. In the simplest version, a magnet is encapsulated in a middle ear prosthesis so that it can be energized by an external coil to vibrate the ossicles. The sound is particularly clear and preferred compared with the sound of conventional hearing aids. Whereas this type of device is still experimental, it is expected to be available soon. The magnetic bone screw is available and is being used for the treatment of certain types of conductive and mixed hearing loss. In the future it may well be possible that these implant instruments will also be used for neurosensory loss because of the improved sound clarity they provide.

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Conserving Hearing in Acoustic Tumor Operations

OF THE 2,500 PATIENTS with acoustic tumors removed at the Otologic Medical Group, Los Angeles, only 5% were candidates for hearing preservation operations. Unfortunately, the tumor is usually too large at diagnosis for this procedure. In selected cases, however, hearing conservation may be possible using the middle fossa or retrosigmoid approach.

The two most important factors to be considered are the size of the tumor and the level of preoperative hearing. Secondary factors are the preoperative results of brain-stem evoked response audiometry (BERA) and electronystagmography (ENG).

The limit of the tumor size for the middle fossa approach is 1.5 cm and for the retrosigmoid approach is 1.5 to 2 cm. We also prefer patients with good preoperative hearing as candidates for hearing preservation operations. Our guidelines are a speech reception threshold of at least 30 dB and a speech discrimination of 70%.

In our series of 106 patients with removal of middle fossa acoustic tumors, patients with tumors arising from the superior vestibular nerve had a better hearing outcome than those with tumors from the inferior vestibular nerve. This may reflect a greater involvement of the cochlear nerve or cochlear blood supply by tumors developing in the inferior compartment of the internal auditory canal. Preoperative ENG is helpful to predict tumor origin. When such testing showed hypoactive calorics, indicating a superior vestibular nerve tumor, hearing was preserved in 64% of patients. Only 48% of patients had their hearing preserved when the preoperative calorics were normal.

There is a trend toward a better rate of hearing preservation with a relatively normal preoperative results of BERA. For patients with a preoperative intra-aural wave V latency difference of 0.4 milliseconds or less, hearing was preserved in 78%. For greater latency differences, the hearing preservation rate dropped to 58%. With no response on BERA, postoperative measurable hearing remained in only 50% of patients.

In summary, the ideal candidate for hearing preservation during acoustic tumor removal should have good preoperative hearing, a small tumor, near-normal preoperative results on BERA, and hypoactive calorics on preoperative ENG. The needs of the patient should also be considered, however, and these criteria should be tailored to each patient.

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Botulinum Toxin for Treatment of Spastic Dysphonia

SPASTIC DYSPHONIA is a voice disorder of unclear etiology yet clinically distinguishable by strained, staccato, effortful speech with voice arrests. The vocal abnormality results from spasm or hyperadduction of true and false vocal cords. It is believed to be a focal dystonia, similar to essential blepharospasm, yet the underlying pathophysiology is poorly understood. It has been proposed to be a heterogeneous disorder including different subtypes—psychogenic, neurologic, and idiopathic—or part of a generalized neurologic disorder.

Diagnosing spastic dysphonia involves subjectively evaluating a patient's speech. Although videostroboscopy can be helpful in identifying a laryngeal tremor, standard laryngoscopy, acoustic analysis, glottography, and electromyography are often not helpful. A lack of understanding of the pathophysiology of this disorder has resulted in a myriad of treatments including speech therapy, psychotherapy, biofeedback, muscle relaxants, tranquilizers, and anticonvulsant therapy. The results from these types of therapy, however, have been disappointing. In 1976 recurrent laryngeal nerve section was introduced, which has been the single most effective treatment of refractory spastic dysphonia. The initial results were excellent, but recent long-term reports have found the results to be temporary with a return of symptoms despite unilateral vocal cord paralysis.

Botulinum toxin has been used to temporarily paralyze selected muscle groups to relieve spasm in such conditions as blepharospasm, torticollis, and, more recently, spastic dysphonia. Botulinum toxin A is one of the neurotoxins produced by *Clostridium botulinum.* It interferes with presyn-